two American Black Snakes (Zamenis constrictor), ten Pennsylvanian Mud Terrapins (Cinosternum pennsylvanicum), four Adorned Terrapins (Chrysemys ornata), thirteen Elegant Terrapins (Chrysemys scripta elegans), six Lesueur's Terrapins (Malacoclemmys lesueuri), six Red Newts (Sperlepes ruber) from North America, a Garnett's Galago (Galago garnetti) from East Africa, a Serval (Felis serval) from Africa, a Common Teguexin (Tupinambis teguexin), three Annulated Terrapins (Nicoria annulata) from South America, four Blue Wall Lizards (Lacerta muralis, var. coerules) from Faraglione, five Schlagintweit's Frogs (Rana cyanophlyctis) from Southern Asia, deposited; a Barbary Wild Sheep (Ovis tragelaphus, &), born in the Gardens.

## OUR ASTRONOMICAL COLUMN.

THE DARK FRINGES OBSERVED DURING TOTAL SOLAR ECLIPSES. - We have received a communication from Señor V. Ventosa, astronomer at the Madrid Observatory, concerning the appearance and probable cause of the dark fringes-or "shadow bands" as they are generally called—which are always observed some few seconds before and after totality during the progress of a total eclipse of the sun. The chief points of his communication are here summarised.

These alternating dark and bright fringes are parallel to each other, all moving in the same direction, but the velocity varies greatly from time to time. Several reasons have been advanced to account for their appearance, chief of which are those regarding them as (1) diffraction fringes bordering the actual shadow of the moon on the earth's surface; (2) shadow phenomena produced in the body of our own atmosphere, and affected by the direction of the wind. The examination of the observed facts appears to support to some extent those holding the latter view, as while the bands may be well seen in one place, they may be invisible in a neighbouring locality; their form, generally rectilinear or slightly undulating, is also variable, while their breadth has been variously estimated from I cm. to 50 cm., although this will, of course, partly depend on the inclination of the surface on which they are observed. Sometimes they move with about the speed of a man walking, at others with the speed of an express train, the velocity always being less, however, than that of the shadow itself. (During the coming eclipse the shadow will move through 800 kilom. in 12 minutes.)

Señor Ventosa has been occupied for some time in studying the currents in the higher regions of our atmosphere by observing the undulations round the sun and stars with a telescope, and thinks that these upper atmospheric currents may possibly have some bearing on the question of the eclipse shadow bands; the movement of these higher portions showing through the quieter lower strata and being rendered visible on account of different refractive powers. He thinks it would be useful to determine the velocity of these currents by anemometers at various altitudes, and also to observe the undulations round the limb of the sun at the time of eclipse, comparing them with the shadow bands in direction and velocity of movement. To ascertain if any experimental illustration of this hypothesis could be presented, he states that bands may be produced by passing diffuse light reflected from a sheet of corrugated glass through a circular aperture representing the sun, over which an opaque disc, representing the moon, is made to slide. When the segment left uncovered is about 5 mm. in width, alternate bright and dark bands can be observed on a white screen held near, if the length of the segmental opening is approximately parallel to the undulations of the glass, but if at right angles they entirely disappear. He trusts, however, that his putting forward this hypothesis for establishing a connection between eclipse shadow bands and atmospheric undulations will show the advisability of recording the direction and velocity of the wind during eclipses, so that more definite data may be available for discussion.

PHOTOMETRY OF CORONA, APRIL 16, 1893.—In a communication recently made to the Royal Society, Prof. H. H. Turner, F.R.S., gives the details of procedure and results obtained in photometric observations of the corona during the total eclipse of the sun in April 1893. The visual brightness of

the corona was determined by Prof. T. E. Thorpe at the eclipses of 1886 August 29, and 1893 April 16, by a method arranged by Sir W. Abney (*Phil. Trans.* A, 1889, p. 363, and 1896, p. 433), but soon after the first of these, Sir W. Abney devised a method of comparing the coronal light with that of a fixed standard by photographic means. This method was first put into practice at the eclipse of 1889, and has been repeated systematically since. Part of the photographic plate, before being taken for eclipse use, is exposed to a graduated series of exposures from a standard source of light in the laboratory, and then without development is afterwards used to receive the impression of the corona, the part carrying the previous standard exposures being protected from further light action. On subsequent development there results a picture of the corona, and a series of squares of graduated densities on the same plate, so that the brightness of any part of the coronal structure may be directly compared with the brightness of the standard light of the laboratory.

The 1889 photographs have not yet been measured, but Prof. Turner has reduced several of the plates taken in 1893 by Sergeant Kearney at Fundium, Africa. These were obtained with the "double tube" apparatus, giving pictures of two sizes, the moon's disc being 0.6 inch and 1.5 inches in diameter. Examples of each scale image were examined, one of the large scale photographs, taken with an exposure of 50 seconds, being specially carefully measured along four radii extending due N., S., E., W., from the limb respectively, and the resulting table of comparison measures is included in the present paper.

This table shows :-

(1) That the accuracy of the method is such that the intensity

of the light is determinable within a very small error.

(2) The intensity of the coronal light falls off in nearly the same manner in all four directions (1893 was near a sun-spot maximum, with corona of symmetrical form). There is a marked difference, however, between the intensities along the north and south radii.

(3) The falling off in intensity is at first exceedingly rapid, becoming very gradual at distances more than 45 minutes from

the limb.

(4) The absolute brightness of the corona in terms of the

"moon" by using a conversion factor.

Prof. Turner then compares the brightness thus determined photographically with that obtained visually by Abney and Thorpe, and presents two curves showing the combined observations, which show a marked agreement between the results arrived at in such different ways. No measures of brightness, however, were made visually within 0 6 of a radius from the limb, and it would be useful if this were done at the coming

MAXIMUM DURATION OF TOTALITY FOR SOLAR ECLIPSE.— Mr. C. T. Whitmell sends us the following corrections to the data given in the abstract of his paper last week (p. 64):-

> Earth's radius to be taken as 3963'296 miles. Moon's ,, ,, ,, ,, 1080'000 ,,

The eclipse for which the totality will be a maximum will take place at noon about the beginning, not the middle, of July.

## SOME MODERN EXPLOSIVES.1

NEARLY thirty years ago, in the Royal Institution, I had the honour of describing the great advances which had then recently been made both in our knowledge of the phenomena which attend the decomposition of gunpowder, and in its practical application to the purposes of artillery.

I described the uncertainty which up to that date had existed as to the tension developed by its explosion, the estimates varying enormously from the 101,000 atmospheres (about 662 tons on the square inch) of Count Rumford to the 1000 atmospheres (6 6 tons per square inch) of Robins, or, taking more modern estimates, from the 24,000 atmospheres (158 tons per square inch) of Piobèrt and Cavalli to the 4300 atmospheres (about 29 tons per square inch) of Bunsen and Schischkoff.

These uncertainties were, I think I may say, set to rest by certain experiments carried out both in guns and close vessels at Elswick, by the labours of the Explosive Committee appointed

 $^1$  A Discourse delivered at the Royal Institution on Friday, March 23, by Sir Andrew Noble, K.C.B., F.R.S.